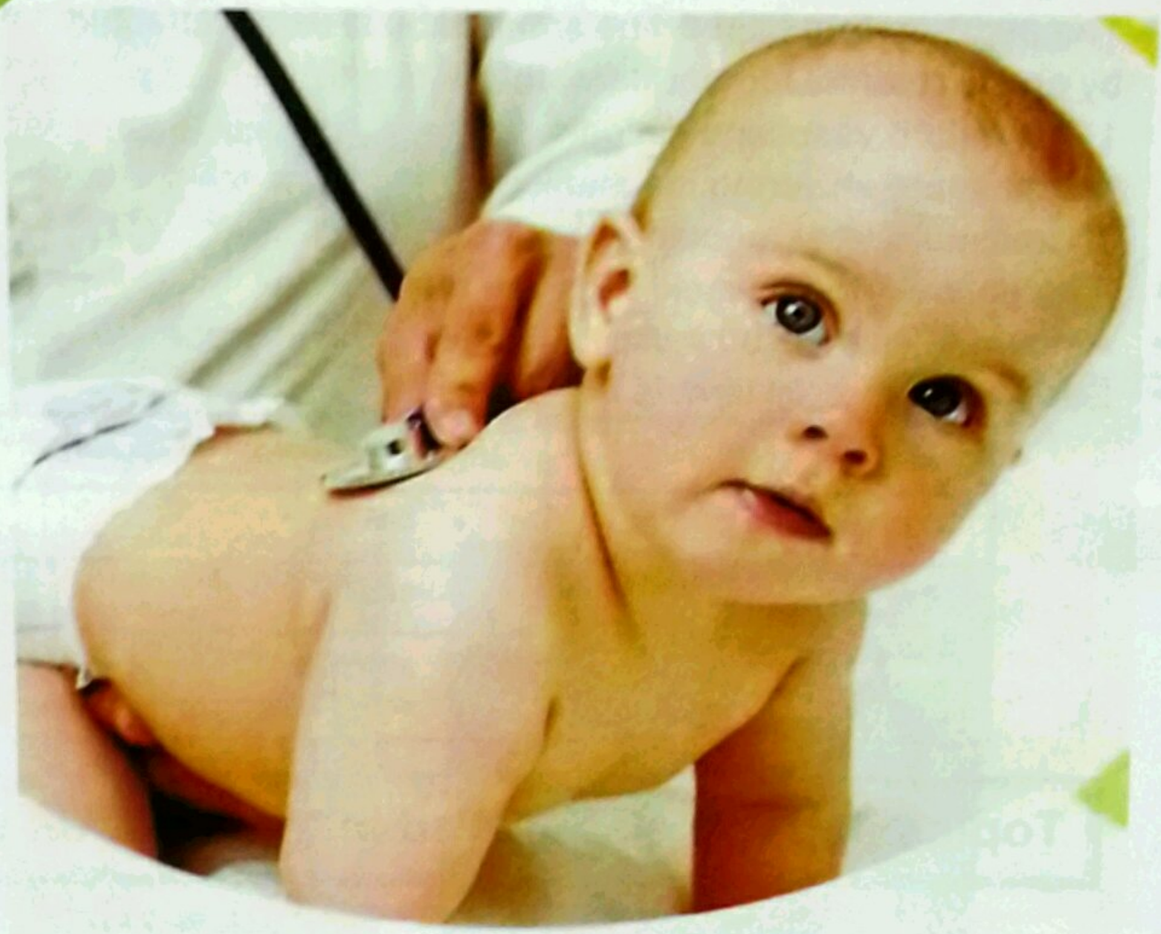
CHAPETR 15



PEDIATRIC SURGERY

GENERAL PRINCIPLES



- Rate of deterioration in children is more rapid than in adults.
- Starvation in children cannot exceed 6 hours.
- Breathing is the most energy consuming.
- □ of the alveoli only are present at birth.
- Morphine in small infant is 0.1mg/kg 6-8 hours daily.
- Temperature regulation: The small baby is easily affected by environmental temperature, this is due to:
  1. Immature vasoconstriction.
  2. Immature shivering mechanism.
  3. Immature heat regulating center.
- If no enteral for > 1 week, TPN is a must.
- Amount of blood is 80 ml/kg, 280 ml in a 3.5 kg neonate.
- Body water in a full term is 80%.

	• Maintenance IV fluids /day
• Neonate	• 60ml/kg
• <10 kg	• 100 ml
• >10 kg	• 100ml for 1st 10 kg+50 ml for each extra kg

Topics that will be covered in this chapter are

- Hernia
- GIT
- Urosurgery
- Plastic surgery
- Childhood tumors

HERNIA IN PEDIATRICS

A. Congenital umbilical hernia (Exomphalos = Omphalocele)

Definition

⇨ **Pathological:** protrusion of a viscus or part of the viscus through congenital defect in abdominal wall.

⇨ **Clinical:**
1. Reducible or gives history of reducibility
2. Gives expansile impulse on cough.
3. On the anatomical site of hernia.

⇨ **It presents at birth.**

Etiology



- Failure of all or part of the midgut to return to the abdomen (persistence of physiological umbilical hernia)
- There is a defect in the anterior abdominal wall.

Types



Exomphalos minor <5cm



Exomphalos major >5cm

I. Exomphalos minor

- **Defect:** small (< 5 cm) at the umbilicus (central cord).
- **Sac:** small (peritoneum).
- **Coverings:** Wharton's jelly and layer of amniotic membrane.
- **Content:** one loop of small intestine or Meckel's diverticulum.
- **Complications:** during ligation of the umbilical cord, a loop of intestine may entangled in the ligature accidentally → resection (umbilico-enteric fistula?).
- **Treatment:**
  - Content is reduced.
  - Sac is excised.
  - Defect is repaired in layers.

II. Exomphalos major

- **Defect:** larger (> 5 cm) in the center of abdominal wall (usually supra-umbilical, eccentric cord).
- **Sac:** large (peritoneum).

- **Coverings:** only a layer of amniotic membrane covers the sac.
- **Content:** any abdominal viscera e.g. **liver** (specifically, it is adherent to the sac), stomach, bowel, spleen…etc.
- **Complications:** rupture of the sac and coverings may occur → infection → peritonitis (the cause of death).
- **Treatment: Urgent surgery**
  - ***A. If the abdominal cavity can accommodate the contents:***
    Primary closure under moderate tension is done.
  - ***B. If the abdominal cavity can't accommodate the contents:***
    1. *Skin flap closure:*
       - Undermine the skin and close as one layer by with simple sutures.
       - Two release incisions may be needed.
       - If survives→ definitive repair after several months *(Usually fails)*.
    2. *Recently → staged closure:*
       - Cover the defect with synthetic material
       - Apply gradual pressure to ↑ size of abdominal cavity.
       - If survives→ definitive repair.

N.B. **If associated with multiple congenital anomalies (or unfit for surgery) →** paint the viscera with alcohol and conserve.

Gastroschisis:
- It is a congenital umbilical hernia but the peritoneal sac is not intact.
- The viscera may or may not be covered with amniotic membrane.
- There is controversy whether to consider it a separate entity or not.
- Management of gastroschisis remains the same as congenital umbilical

B. Infantile Umbilical Hernia

Definition

⇨ **Pathological:** protrusion of a viscus or part of the viscus through a defect in abdominal wall.

⇨ **Clinical:**
1. Reducible or gives history of reducibility.
2. Gives expansile impulse on cough.
3. On the anatomical site of hernia.

⇨ It presents few weeks or months after birth.



Protruded umbilical Scar

Incidence

⇨ More in black races.

Etiology

⇨ Weak umbilical scar (due to infected umbilical stump, Cicatrix).

Pathology

- **Defect** is ***exactly at*** the umbilicus.
- **Sac:** peritoneum, small, conical with wide neck.
- **Contents:** omentum, bowel or both.
- **Coverings**: stretched umbilical scar & extra-peritoneal fat.
- **Neck** of the sac is wide → rare to be strangulated.

Clinical picture

A. Clinical Picture of the case: ***painless swelling (unless complicated), characterized by***:
   1. Reducible or gives history of reducibility.
   2. Gives expansile impulse on cough or crying (unless complicated).
   3. On the anatomical site of hernia.

B. Clinical picture of complications (if present).

C. History of precipitating factors e.g. phimosis (constricted foramen of prepuce).

Fate

- Spontaneous closure in the 1st few months of life is the usual fate (85%).

Complications

- Rare.

DD

	Congenital umbilical hernia	Infantile umbilical hernia
Covering	Amniotic membrane	Skin
Presentation	Dated since birth	After few weeks (falling of umbilical stump) → umbilicus is everted.

Treatment

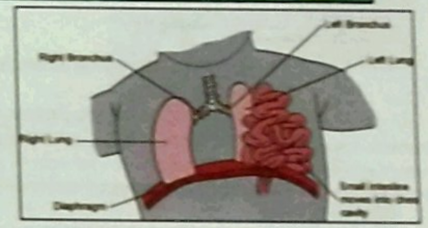
Reassurance of the parents & ***follow up*** are the usual measures.
(The defect usually ***closes spontaneously*** within 2 years in 95% of cases)

- **Treatment of the precipitating factors** e.g. phimosis → circumcision.
- **Coin & plaster strap!!!** (No need as defect closes spontaneously).
- **Indications for surgical correction:**
  1. Large defect (> 2 fingers). 2. > 2 years old. 3. Strangulation.
  → Anatomical repair with proline sutures.

C. Congenital Diaphragmatic Hernia

Definition

It is a herniation of some of abdominal contents through a congenital defect in the diaphragm.



Incidence

1: 4000

Embryology

A. Normal development:
1. Fusion of septum transversum and the pleuroperitoneal folds occurs bilaterally during the 8th week of intrauterine life (right side before left side).
2. Intestine returns to abdomen for rotation and fixation at 10th week.

B. Maldevelopment & it's consequence:
1. Failure of diaphragmatic development at 10th week → persistence of pleuroperitoneal hiatus (Foramen of Bockdalek) → Herniation of intestinal loop to chest (Posterior diaphragmatic hernia) → Compress on the lung → interface with its development → May lead to severe hypoplasia of the lung.
2. Failure of fusion between costal & sternal parts of the diaphragm → Morgagni hernia (Anterior diaphragmatic hernia).

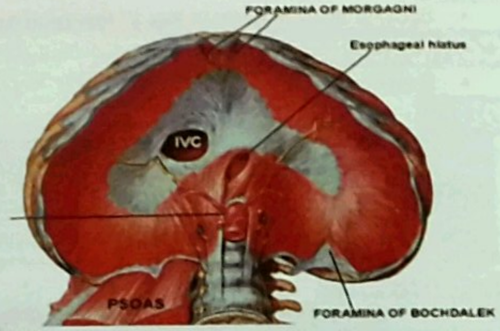
3. Eventration (abnormal elevation) of the diaphragm:
- Rare condition
- Characterized by severe loss of strength of the diaphragm's muscular and fibrous parts →very flabby diaphragm → Protrudes into the pleural cavity.

Types

➤ ***Main types of CDH:*** لأن الطبيعي اليمين بيتقفل بدري عن الشمال

1- Bochdalek hernia / Posterior hernia (Left : right = 5:1)
2- Morgagni hernia / Anterior hernia (Opening of internal mammary artery).
3- Eventration of diaphragm (Not a true hernia)

► Bochdalek is the commonest diaphragmatic hernia in infants.
► Sliding H.H is the commonest diaphragmatic hernia in adults.



Presentation

- **Antenatal Diagnosis:**
  - Maternal polyhydramnios.
  - Antenatal U/S is diagnostic

► Any newborn with respiratory distress (cyanosis) in absence of heart disease and a scaphoid abdomen is considered congenital diaphragmatic hernia until proved otherwise

- **At birth:**

Severe cases
- Presents immediately after birth.
- There is respiratory distress & gasping
- General examination: Cyanosis & tachycardia
- Local examination:
  1. **Chest:**
     - Presence of intestinal sounds on the ipsilateral side of the chest (rare)
     - The heart sounds are better heard on Rt. Side in case of the common left sided hernia.
  2. **Abdomen:**
     - Scaphoid abdomen



Portions of intestine and spleen in the left chest with the heart displaced into the right chest

Mild cases

→ Either:
1. Late presentation by recurrent chest infections.
2. Accidental discovery by auscultation of bowel sounds on the chest

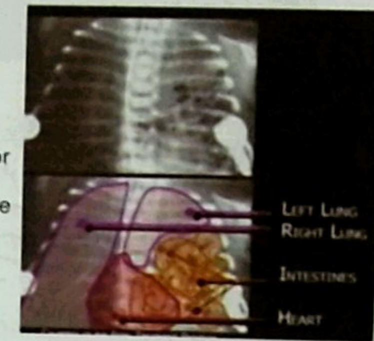
DD

Other causes of neonatal respiratory distress:
1. Hyaline membrane disease.
2. Esophageal atresia with aspiration.
3. Congenital heart disease.

Complications

1. Ipsilateral pulmonary hypoplasia → pulmonary hypertension → leads to Rt. To Lt shunt
2. Contralateral compression of lung by abdominal contents..
3. Ischemia of herniated contents.

Investigations



1. **Radiological:**
   - **Plain X-Ray:**
     ➤ It will demonstrate:
     - Presence of gas shadow of the stomach or bowel in the chest cavity.
     - Shift of trachea and the mediastinum to the contralateral side.
     - Apparent dextrocardia.
   - **Gastrografin meal:**
     - Presence of stomach and intestinal loops within chest cavity.
   - **Antenatal diagnosis by U/S and Echo:**
     - May be used prenatal, it will show bowel in chest cavity.
   - **Echo** for associated cardiac anomalies and degree of portal hypertension.
   - **CT scan chest.**
2. **Laboratory:**
   - **Blood gases:**
     - Assess degree of hypoxia, hypercapnea & acidosis.

Treatment

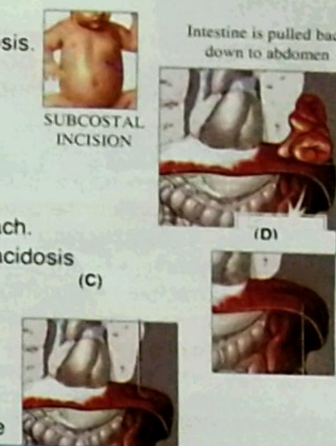
➤ **Surgical treatment is the rule:**

Preoperative Preparation

→ **In pediatric surgical centre**
1. Nasogastric tube (NGT) to decompress the stomach.
2. Mechanical ventilation to correct hypercapnea & acidosis
3. I.V. fluids
4. Incubator to keep body temperature

Operation

- Through abdominal approach.
- The herniated contents are reduced
- The defect is closed directly or a mesh is used if the defect is too big.



Reduction of the hernia with repair of the diaphragm

Postoperative

Continue ventilatory support

Prognosis

→ The honeymoon period lasts between 2-5 days postoperative.
→ After this period pulmonary hypertension develops causing right to left shunts.
→ Death may occur in about 50 % of cases.

➤ **Modern trends in treatment:**
- Intrauterine surgical correction.
- Nitric oxide may be used as it induce pulmonary VD.
- ECMO (Extracorporeal membranous oxygenation) may be used to facilitate oxygenation until the lung matures

GIT IN PEDIATRICS

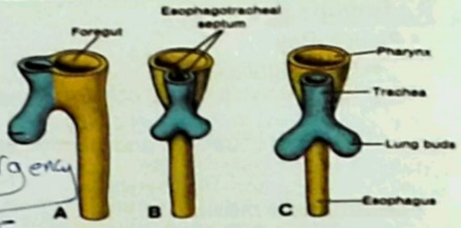
A. Esophageal Atresia

Definition

- Failure of recanalization of foregut.

Incidence

- 1: 4,000.
- Sex: Male > female.
- Race: White > Black

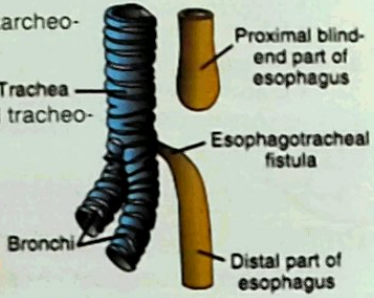


Etiology

- Multifactorial:
  a) Genetic abnormalities
  b) Environmental factors

Pathology

- Defect in division of proximal foregut into ventral tarcheo-bronchial tube & dorsal esophageal tube.



Types

1. Blind upper pouch & fistula of lower pouch (Distal tracheo-esophageal fistula) → ***COMMONEST* (87%)**
2. Rare types include: Atresia without fistula (7%)

Complications

1. Proximal esophageal atresia → Accumulation of saliva and milk in the upper pouch → become filled → start dropping in :
   a. Mouth → Frothy saliva
   b. Trachea → Bronchopneumonia
2. In tracheo-esophageal fistula → Regurgitation of acidic gastric juice into the lungs → acid pneumonia (fatal)
3. Failure of feeding → Dehydration & hypoglycemia
4. Complications of associated anomalies

Associated anomalies (*VACTERL syndrome*)

- ***V**ertebral* → Spina bifida.
- ***A**nal* → Imperforate anus
- ***C**ardiac* → Fallot tetralogy, VSD, ASD.
- ***T**racheal* → Tracheo-esophageal Fistula
- ***E**sophageal* → Atresia
- ***R**enal* → Polycystic kidney
- ***L**imb* → Polydactyly

→ **Pneumonia & associated anomalies are causes of death.**

Clinical Picture

> Any newborn presenting with repeated accumulation of frothy saliva should be considered as having esophageal atresia until proved otherwise.

1. **Antenatal diagnosis:** ***(By obstetrician)***
   - Maternal polyhydramnios.
2. **At birth:**
   - Continuous pouring of saliva since birth ***(pathognomonic)***.
   - Regurgitation of food in the 1st 24 hours.
   - Attacks of chocking, cyanosis & cough
   - Rapid development of pneumonia
   - Associated anomalies may be the presentation (VACTERL)
   - Local examination: Distention of the abdomen with respiration *(If fistula of lower pouch is large.)*

> ► Once esophageal atresia is suspected oral feeding is strictly stopped until it's excluded.

DD

- **Posterior choanal atresia** → Arrest at 2 cm from nostril.

Investigations



B. Antenatal Diagnosis

- *U/S:* → Dilated upper pouch

C. For diagnosis

1) Instrumental:

- ***Catheter test:*** *(Routine check of newborn)* → It will be arrested usually **10 cm** from the nostril.

2) Radiological:

- ***Plain X-Ray: (chest & abdomen)***
  - ✓ Done after inserting nasogastric tube, showing:
    1. Presence fundic air bubble → fistula of lower pouch.
    2. Absent fundic air bubble → blind lower pouch.
    3. Chest: pulmonary complication.
- ***Fiberoptic pediatric esophagoscopy.***

3) Laboratory:

- ***CBC***
- ***ABG*** → To assess the need for assisted ventilation.

D. For Associated Anomalies

e.g. Invertogram for imperforate anus, echo for heart & renal U/S

Treatment

Preoperative

1- NPO (Nothing per os).
2- Continues low pressure suction of saliva.
3- IV fluids & antibiotics.
4- Place the infant in an incubator
5- Transfer to pediatric surgery centre.

> ► It is an **emergency** which should be managed on the first day of life.
> ► Urgent surgery in pediatric center after preoperative care (before breast feeding starts to avoid pneumonia)

Operative

A- Atresia with fistula :
- Rt. thoracotomy.
- Ligation of the fistula then **primary anastomosis.**
- Removal of atretic segment.

B- Atresia without fistula:
- Usually there is a long gap which makes middle anastomosis difficult.
- At birth we do:
  - → Gastrotomy : For feeding.
  - → Esophagostomy: For clearing of the pharynx from saliva, this improves chest condition.
- 6 months later, further surgery to restore esophageal continuity is done.

+ Treatment of associated congenital anomalies

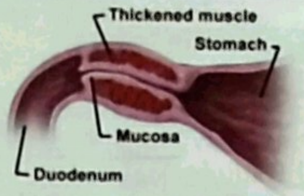
B. Congenital Hypertrophic Pyloric Stenosis (CHPS)

Definition
- Thickening of the pylorus more than 4 mm. (hypertrophied)

Incidence

Normal thickness: 4 mm

- 1/4000 neonates.
- Familial (especially if the mother had CHPS)
- ♂: ♀ ratio is 4 : 1.
- It is more in the first infant.



Etiology
- **Unknown**, may be due to:
  1. Improper innervation of pyloric sphincter.
  2. Reduced nitric oxide synthesis
  3. Increased growth hormone level.

Pathology

Pylorus is normal at birth & pathology starts 2-3 weeks after birth.

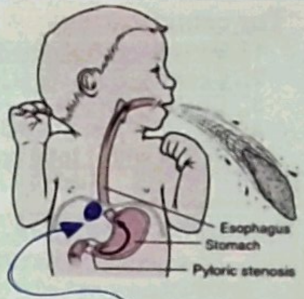
- The pylorus:
  - Gradual progressive hypertrophy in the circular muscle fibers starting 2-3 weeks after birth → gradual occlusion of gastric outlet → suckled milk can't pass → projectile vomiting.
  - Repeated vomiting → water & electrolyte disturbance.
- The stomach:
  - Tries to push contents against the stenosis by contracting. This explains the visible peristalsis seen over the abdomen

Clinical Picture

- **Within 2-3 weeks after birth, never at birth.**

Any neonate presenting with projectile, non bile stained vomiting not responding to antiemetics should be considered to have CHPS until proved otherwise

Symptoms
- One month after birth, the ***mother*** complains that her infants has:



1. **Projectile vomiting:**
   - It is **NOT BILE STAINED** (only milk) & does not respond to anti-emetics.
   - After which hunger pain occurs.
2. **Constipation:** dry firm stools.
3. **Failure to thrive:** progressive weight loss and dehydration.

Signs
- **General:**
  - **Dehydration:** In neglected cases.
  - **Bad chest** (aspiration).
- **Local:** *After a feed, in a good light: (Test Feed)*
  - Upper abdominal distension.
  - ***Visible peristalsis***: from left to right.
  - **Olive like** lump is felt in the transpyloric plane right to right rectus muscle. Better to be palpated during nursing.
    - → ***Called Tumor's sign*** & is ***Diagnostic***

Complications
1. **Dehydration.**
2. **Metabolic alkalosis** (hypochloremic alkalosis) due to HCl loss by repeated vomiting.
3. ↓ **ionized Ca^{+2}** → tetany.
4. **Paradoxical aciduria** (kidneys will excrete H^+ ions instead of Na^+, K^+)
5. **Chest infection & aspiration pneumonia.**
6. **Liver impairment in 2% (due to bad nutritional status).**



DD *Of neonatal vomiting*
1. ***Gastroenteritis***
   - Fever, vomiting, diarrhea and loss of appetite.
2. ***Pylorospasm:***
   - No palpable mass, responds well to antispasmodics.
3. ***I.O.***
4. ***Feeding problems***
5. ***Duodenal atresia***
   - **C/P**: soon after birth
   - Bile stained vomitus
   - **Etiology:** - True : failure of canalization
     - False: annular pancreas
   - **Inv:** x-ray : Double bubble sign
   - **TTT:** R&M then duodenojejunostomy.

Investigations

I. For diagnosis:

► Only required if the mass (olive tumor)is not palpable.

1. **U/S:** ***(most diagnostic)***
   - Diagnostic if pyloric thickness > 4mm
2. **Barium meal:**
   - Dilated stomach.
   - Delayed emptying.
   - Persistent elongation & narrowing of pyloric canal ***(string sign)***.
   - Exaggerated peristalsis

It's very important to assess electrolyte disturbance

'It is more blessed to give than to receive.

2. For complications:

1. **Serum electrolytes** → ↓ Na^+, K^+ & Cl^- & paradoxical aciduria.
2. **Chest X-Ray:** chest infection
3. **CBC:** → anemia.
4. **KFTs:** → prerenal failure.
5. ↓ **HCl with ↑ total acidity**.



Treatment

▶ Surgical Treatment

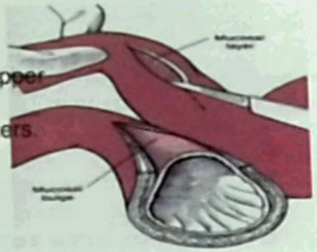
⇨ **Preoperative preparation:** *Correct general condition*

Usually it takes 24 hours to rehydrate the baby

1. **Rehydration by NaCl** & when urine becomes normal give KCl.
2. Stop oral feeding & Nasogastric wash of stomach by saline

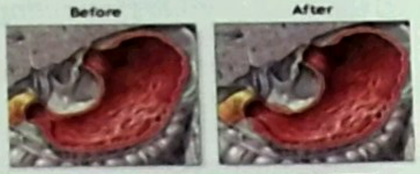
⇨ **Operation: "Ramstedt's Pyloromyotomy"**

1. General anesthesia.
2. Transverse incision (Gridiron incision) in the Rt. upper abdomen (Over the palpable olive tumor).
3. Pylorus is grasped between index and thumb fingers.
4. The serosa & musculosa is cut **till the mucosa bulges.**
5. If mucosal injury → repair with interrupted sutures, and reinforced by omental patch.
6. Closure of the abdominal wound.



Prognosis

⇨ Surgical outcome is excellent & mortality should be around zero.



C. Congenital Megacolon (Aganglionic Megacolon) (Hirschsprung Disease)

Incidence

- 1 / 5000.
- M : F = 4 : 1.

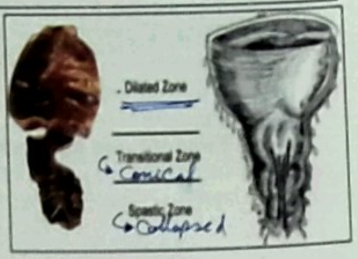


Etiology

- Familial in 6 % of cases.
- It is due to absence of ganglia in the submucous & intermuscular plexus.

Pathology

- The disease starts in the upper part of the anal canal and extends proximally to the recto-sigmoid area in 80% of cases (typical cases) or it may involve variable lengths of the colon or even the whole colon.



- **Macroscopically** There are 3 segments:

Spastic segment	Transitional one	Proximal dilated one
Absent ganglia	Few ganglion cells	Normal ganglion cells
Collapsed	Conical	Dilated

- **Microscopic:**
  - Absence of ganglia of Auerbach's and Meissner's plexus.

Clinical Picture

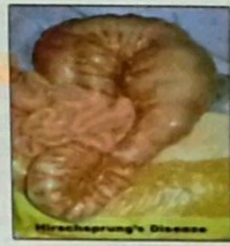
Any newborn presenting with delayed passage of meconium for more than 24 hrs after birth should be considered as having Hirschsprung's Disease until proved otherwise

Symptoms

▶ **Chronic constipation:**

- Delayed passage of meconium > 24 hrs after birth.
- The mother notices: defecation occurs every few days & only after insertion of suppository or during an enema.

Signs



1. **Inspection:**
   - Progressive abdominal distension & visible peristalsis.
2. **Palpation:**
   - Doughy mass in Lt. iliac fossa.
3. **Percussion:**
   - Tympanitic resonance.
4. **Auscultation:** ↑ intestinal sounds.
5. **DRE:** Digital rectal Examination
   - Empty rectum
   - The stenotic segment grips on the finger.
   - Characteristic gush of foetid stool or gases on withdrawal of the finger.

Complications

A. General:

1. Delayed growth and development.
2. Chest infection (aspiration during vomiting).

B. Local:

1- Obstructive toxic enterocolitis (fever, diarrhea and abdominal distension) → **Cause of death.**

2- Acute obstruction.

➢ ***The most important diagnostic tools are:***
- Barium enema
- Rectal biopsy

Investigations

I. Imaging:

- **Plain X- ray:**
  - Large bowel obstruction (haustrations do not reach the other side of the lumen).
  - In toxic enterocolitis perforation → air under diaphragm.
- **Barium Enema:**
  - **Precautions:** MCQ
    - Without preparation, as preparation will mask changes in colonic caliber.
    - Mixed with saline (light barium) to avoid intestinal obstruction.
    - No DRE before the test.



- **Finding:**
  - Will show narrow aganglionic segment with marked proximal colon dilatation.
  - Its accuracy is 80%.

2. Instrumental:

- **Rectal biopsy:** (most diagnostic)
  - Shows absence of ganglion cells.
  - Previously: full-thickness rectal biopsy
  - Nowadays: small segment of mucosa and submucosa is taken by special forceps.
- **Anorectal manometry:**
  - Reveals failure of relaxation of anal sphincters in response to rectal distension.

3. Laboratory: to assess general condition.
- CBC: high TLC, hemoconcentration.
- KFT: pre-renal failure

Treatment

Patients presenting by obstructive enterocolitis
→ **Conservative Treatment**
1- NGT suction.
2- IV fluids.
3- Repeated colon wash-outs with saline.
→ Obstruction is relieved → Prepare for later elective surgery
→ Obstruction is not relieved → Urgent colostomy

Patients without intestinal obstruction
→ Elective surgery after preparation
→ **Preparation:**
1- Repeated enemas.
2- Prophylactic antibiotics
3- Correction of dehydration.

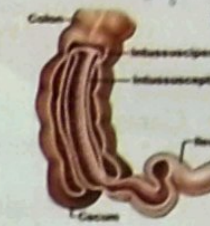
Definitive Surgery:
- **Timing:** ideally at 6-9 months
- **Procedure:**
  - Swenson's operation

Operative Details

Swenson operation:
- It entails complete excision of the aganglionic segment up to 4 inches above the funnel and then anastomosis of the normal colon to the lower half of the anal canal.

D. Infantile Intussusception

Definition



- Invagination of an intestinal segment (intussusceptum) into the lumen of an adjacent one (intussuscipiens) or telescoping.

Pathology

- An intussusception is composed of:
  - 1- Entering or inner layer. } intussusceptum
  - 2- Returning layer
  - 3- Outer layer } intussuscipiens
- The blood supply of the inner layer is liable to be impaired at the neck of intussusception.
- **Ileocecal:** *(75% → commonest)*
  - The terminal ileum invaginates into the colon with the ileocecal valve forming the apex of the intussusception.

Etiology



Infantile intussusception (idiopathic)
- Possible cause is adenovirus → swelling of Peyer's patches (maximum aggregation at terminal ileum) which protrudes into the lumen → acts as a FB → forced distally along the gut.
- Evidence: frequent occurrence of intussusception at age of weaning, summer (due to increased incidence of gastroenteritis).

Clinical Picture

Any infant having colicky abdominal pain with passage of blood-stained mucus per rectum should be suspected of having intussusception until proved otherwise

Type of Patient



Ileo-cecal intussuseption

- Usually a healthy male between 6 – 12 months old (male: female= 2:1).
- Common at the age of weaning or following recent gastroenteritis (caused by adenovirus or rotavirus).

Symptoms

➢ **Pain:**

A. In attacks:
- Characterized by:
  - Crying, screaming & drawing the knees up to the abdomen.
  - It awakens him from sleeping.
  - Pallor, lethargy & apathy.
- Between attacks: well-being child seeking for food.

B. If constant → suspect strangulation.

➢ **Vomiting:**
- Projectile vomiting following attacks of colic in 85% of patients

'It is more blessed to give than to receive.



- **Absolute constipation:**
  - The child passes blood & mucus per rectum which is called **(Red Currant Jelly stools)**.
  - The mother may deny absolute constipation as she is confused by the passage of blood and mucous per anus.

Signs

- **General:**
  - Dehydration: sunken eyes, depressed fontanelles & inelastic skin.
- **Local:**
  - **Inspection:**
    1. **Visible peristalsis** may be observed.
    2. **Distension of the abdomen**
       - Usually absent in early cases.
       - Its presence denotes possibility of perforation or gangrene.
  - **Palpation:**
    1. **Sausage-shaped mass** may be felt → concave towards umbilicus. It hardens during the attack & softens in between attacks.
    2. **Signe de Dance** → right iliac fossa feels empty.
  - **Percussion:** Tympanitic abdomen.
  - **Auscultation:** mad abdomen.
  - **DRE:**
    1. The finger is stained with mucous & blood (present if 60%).
    2. Apex of the intussusception may be felt.
    3. Very rarely, intussusception may protrude through the anus.

> **If complicated by peritonitis:**
> Rigidity, guarding, tenderness & Rebound tenderness

Complications and Cause of Death

- Shock & toxemia from gangrenous segment (1ry intussusception is prone to early gangrene than 2ry intussusception).

DD

1. **Acute enterocolitis:**
   - Faecal matter is present together with the blood & mucus.
2. **Rectal Prolapse:**
   - A finger can be introduced into the rectum along the intussusception, but in prolapse the finger cannot be introduced.
3. **Henoch's purpura:**
   - Purpuric rash is present; it may be associated with intussusception which will need operation.



Investigations

1. **For diagnosis:**
   - U/S with saline → Target sign
   - **Barium enema (Diagnostic & Therapeutic):**
     - In doubtful diagnosis
     - It shows the **"Claw sign"**.
     - Cylidrical filling defect.

2. **For complications:**
   (To assess the general condition of the patient)
   - **CBC:** anemia
   - **Serum electrolytes**
   - **KFTs**

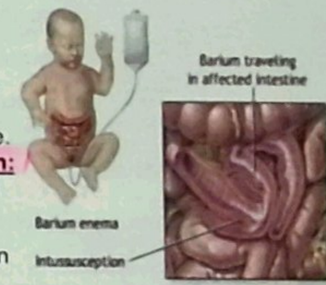
> ***Urgent operation after preparation***

Treatment

Preoperative Preparation

- IV fluids (dextrose & saline) and antibiotics.
- NG suction.
- Catheterization.
- Monitoring.

Hydrostatic Reduction



- **Indications:** only early non complicated case.
- **Contraindications to hydrostatic reduction:**
  1. Late cases (> 48 hours).
  2. Presence of abdominal distension or rigidity; i.e. complicated.
  3. Doubtful diagnosis → exploration should be done.
- **Method:** **using barium enema.** Barium is running through the rectum under pressure (not more than 120 cm H_2O).
- **Success rate:** 75 – 95 %.
- **Success of reduction is confirmed by:** Filling of the small intestine for more than 5 cm by barium & quick clinical improvement.



Surgical Reduction



- **Indications:**
  1. Late complicated cases from the start.
  2. Failure of hydrostatic reduction.
- **Steps:**
  1. Anesthesia: General.
  2. Incision: Right paramedian.
  3. Procedure:
     - **Squeeze method:**
       - The mass is reduced by squeezing the head gradually backwards out of the containing colon (never to pull on the ileum).
       - The most difficult part to be reduced is the last part.

> **If the intussusceptum is irreducible or gangrenous, resection & end to end anastomosis**

- **Prognosis:**
  1. Mortality: Is high in gangrenous lesions.
  2. Recurrence: in 2% of cases.

E. Pediatric Intestinal Obstruction

Etiology

A. **Dynamic:**
- Lumen:
  1. Meconium ileus.
  2. Meconium plug syndrome.
- Wall:
  1. Congenital atresia:
     - Esophageal atresia, duodenal atresia, jejunal atresia, ileal atresia, colonic atresia.
  2. Congenital megacolon.
  3. Imperforate anus.
- Outside the wall:
  1. Volvulus neonatorum.
  2. Strangulated inguinal hernia.
  3. Peritoneal bands.
  4. Annular pancreas.

B. **Adynamic:**
- Necrotizing enterocolitis and septicemia.

Clinical Picture

- **Common for all causes**

Symptoms

1. Vomiting and dehydration.
2. Colicky abdominal pain.
3. Absolute constipation.

Signs

1. Abdominal distension.
2. Visible peristalsis

- **According to the cause**

1- Volvulus neonatorum: bleeding per rectum.

2- Imperforate anus.
- **General examination:**
  To exclude associated congenital anomalies (VACTERL syndrome).
- **Examination of the perineum:**
  - Look for the presence of anus, its size and site
  - Look for the presence of an anal dimple
  - If there is an impulse on crying at the site of the anus, it denotes a low anomaly.
  - In ectopic anus, there is a subcutaneous fistulous track full of meconium.

3- Hirschsprung's disease:
- **Symptoms:**
  - Delayed passage of meconium.
  - Defecation occurs every few days.
- **Signs (DRE):**
  - Empty rectum.
  - Grips on the finger.
  - Characteristic gush of stool on withdrawal of the finger.

Investigations

- **Plain X-Ray:**
  - Erect: multiple fluid levels.
  - Supine: shows the level of obstruction.
- **According to the cause:**
  a. Hirschsprung's disease:
  - Barium enema: narrow aganglionic segment with proximal colon dilatation.
  - Rectal biopsy: absence of ganglion cells.

  b. Imperforate anus:
  - Invertogram: the distance between coin & distal gas shadow is measured:
    - If < 1 inch → low anomaly
    - If > 1 inch → high anomaly
  - IVP: to exclude associated urinary tract anomalies.



Double bubble sign (duodenal atresia)

Treatment

Preoperative preparation

- IV fluids & electrolytes.
- NG suction.
- Catheter: to monitor urine output.

Operation

- **Time:** 10 months, 10 Kg & Hb 10 gm/dL
- **Procedure:** according to the cause:
  - Hirschsprung's disease:
    - Excision of aganglionic segment with anastomosis of normal colon with lower ▯ of the anal canal.
  - Imperforate anus:
    1. High anomalies:
       ⇨ Treated with staged surgery:
       - First stage: Temporary colostomy
       - Second stage: Anorectal pull-through (abdominal approach)
       - Third stage: closure of colostomy.
    2. Low anomalies:
       a- Covered anus:
       - Excision of skin bar.

       b- Membranous anus:
       - Cruciate incision of the membrane with trimming of edge.

       c- Ectopic anus:
       - Cut-back operation.

       d- Anal stenosis:
       - Dilatation.

F. Individual causes of pediatric intestinal obstruction

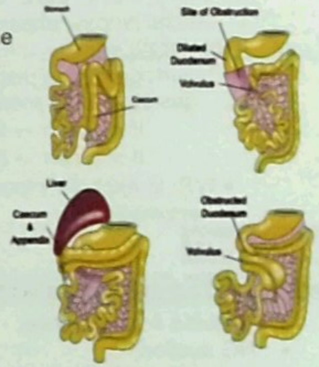
I. Volvulus Neonatorum

Etiology

- The condition is caused by incomplete rotation of the midgut that should occur during intra-uterine life.

Pathology

- The baby is born with a free midgut having a narrow-based mesentery → liable to twist around its mesenteric axis → strangulation obstruction of the whole midgut.
- There is usually a fibrous band that extends from below the liver to the left to the cecum which lies in the epigastrium. This can obstruct the duodenum.



Management

Urgent surgery:

1- Untwist the gut
2- Divide the band
3- Broaden the base of its mesentery by further displacement of the cecum to the left.

II. Jejunal & ileal atresia

Etiology

Vascular problem

- Due to obstruction of mesenteric arteries in utero
- The atretic segment of the bowel may be a cord like structure or completely absent.

Clinical picture

- **Jejunal atresia:** Early bilious vomiting but distention is lacking.
- **Ileal atresia:** Abdominal distention is marked while vomiting maybe delayed.
- **In both:** Meconium may be evacuated.

Investigations

- Plain abdominal x-ray → Distended bowel loop with fluid levels

Treatment

- Urgent surgery is required. Resection of the atretic segment is done with bowel anastomosis.

III. Meconium ileus

Incidence

- Occurs in 10 % of patients with cystic fibrosis (mucoviscidosis)

Pathology

- Thick inspissated meconium → obstruction of ileum in in neonates

Investigations

★ **Gastrografin enema:**

- May be diagnostic
- May be therapeutic as it absorbs water that may dissolve the thick meconium

Treatment

- Ileostomy may be needed & may be life saving.

IV. Peritoneal bands

- Peritoneal bands, e.g. band of ladd, or bands in relation to meckel's diverticulum may compress the lumen or precipitate volvulus.

V. Strangulated inguinal hernia

Incidence

- Commonest cause of partial or complete intestinal obstruction during the first 6 months of life.

Treatment

- Urgent surgery is required.

G. Meconium plug syndrome

- Term used to describe baby with:
  1. Distal colonic obstruction +
  2. Narrow left colon +
  3. Thick plug of meconium in the distal colon.
- The baby is otherwise normal.
- Treated by gastrografin enema. (curative)

H. Necrotizing enterocolitis (NEC)

- Most serious & frequent GIT disorder in predominantly premature infants.
- Occurs after 10 days from birth.

Incidence

- Increasing due to better therapy in neonatal intensive care, allowing more premature babies to survive.

Pathology

- Necrosis, ulceration & sloughing of intestinal mucosa → progress to full thickness necrosis & perforation.
- Gas-forming bacteria in intestinal wall may lead to pneumatosis (air in intestinal wall)

Investigations

- **Plain X-Ray:**
  → Erect & supine showing pneumatosis.

> Contrast studies are dangerous because may lead to perforation.

Treatment

▶ Medical Treatment

1. Stop feedings.
2. Orogastric suction.
3. Correction of hypoxia, hypovolaemia, acidosis & electrolyte disturbance.
4. Systemic antibiotics.

▶ Surgical Treatment

- The **only** absolute indication for surgery is **intestinal perforation**.
- **Laparotomy:**
  1. Necrotic bowel is resected.
  2. Proximal bowel is made into a stoma.

> 1ry anastomosis is not safe

- **Complications:**
  1. Short bowel syndrome → due to extensive resections.
  2. Intestinal strictures → due to healing.

I. Imperforate Anus

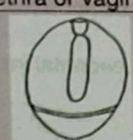
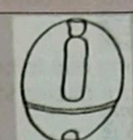
Incidence

- 1 / 5000

Types

1. High anomalies (More common)

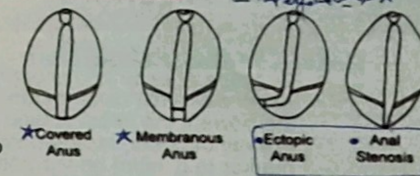
- Failure of the rectum to pass through the pelvic floor.
- The rectum is proximal to the pelvic floor.
- Usually associated with fistulous communication with posterior urethra in males or vagina in females.
- M : F = 2 : 1.
- **Types:**

Type	Anorectal agenesis	Rectal Atresia
Rectum	Blind pouch above the pelvic floor	Blind pouch above the pelvic floor
Anal canal	Absent	Blind pouch below the pelvic floor
Associations	Fistulous communication between rectum and UB or urethra or vagina.	
		

- **Persistent Cloaca:**
  - Only in females.
  - The bowel, UB and genital tract are all opened at a common wide cavity (Cloaca)

2. Low anomalies (Less common)

- The rectum is distal to the pelvic floor.
- M : F = 1 : 2.
- Not associated with other anomalies
- No defect in anal sphincter



a- Covered Anus:
The anal canal is covered by skin bar and usually opens into an ectopic site anterior to normal position.

b- Membranous Anus:
There is a membrane at the dentate line → retained meconium → bulging of this membrane.



Anal Stenosis

Associated Anomalies

VACTERL, more common in high than low anomalies.

Clinical Picture

A. General examination:
To exclude associated congenital anomalies.

B. Abdominal examination:
There may be evidence of intestinal obstruction.

C. Examination of the perineum:
1. Presence of anus, its size and site
2. Presence of an anal dimple
3. **If there is an impulse on crying at the site of the anus → low anomaly.**
4. Subcutaneous fistulous track full of meconium → ectopic anus
5. **Meconium at the tip of the penis → fistula to the bladder or urethra.**
6. If the thermometer can be introduced into the anus for > 1 cm, this excludes rectal atresia.

DD

(Of neonatal intestinal obstruction):

1. **Duodenal atresia:**
   → Vomiting (bile stained or not) → Double bubble sign on x-ray.
2. **Volvulus neonatorum:**
   → Abdominal colic, bile stained vomiting & bleeding per rectum.
   → Doppler shows affected bowel blood flow.
3. **Meconium ileus:**
   → Thick meconium
   → Gastrografin is diagnostic & therapeutic.
4. **Hirschsprung disease *(long segment)*:**
   → Barium enema shows stenotic colon.
   → Biopsy is diagnostic.

'It is more blessed to give than to receive.

Investigations

A. Radiological:


Rectal atresia

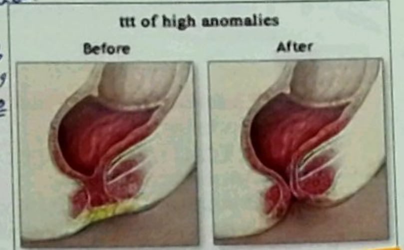
- **Plain X-ray (invertogram):**
  - 24 hours after birth (enough time for gas to travel along the colon to reach the distal end of the bowel), the infant is held upside down for a few minutes with radio-opaque marker (e.g. coin) on the possible site of the anus.
  - We can differentiate between high & low anomalies by:
    1. Measuring the distance between coin and distal gas-shadow:
       - ⇨ If < 1 inch → low anomaly.
       - ⇨ If > 1 inch → high anomaly.
    2. Determining the site of termination of bowel:
       - ⇨ Proximal to the pubo-sacral line → High anomaly
       - ⇨ Distal to pubo-sacral line → low anomaly
- **IVP:** (In high anomalies) لازم
  - For urinary anomalies
  - If bladder gases are present → high with fistula.

B. Laboratory:

- **Urine analysis:**
  - If meconium is present → fistulous communication with UB

> - ***Associated anomalies must be excluded:*** e.g.
>   - Esophageal atresia → catheter test
>   - Cardiac anomalies → echo.
>   - Renal anomalies → abdominal U/S, IVP.

Treatment



1. **High anomalies:** → Pull through operation
   ⇨ Treated with staged surgery:
   - First stage: Temporary colostomy
   - Second stage: Anorectal pull-through (abdominal approach)
   - Third stage: closure of colostomy.

Results are not satisfactory because continence may be weak.

2. **Low anomalies:**
   - Only perineal surgery.
3. **Treatment of associated anomalies if found.**

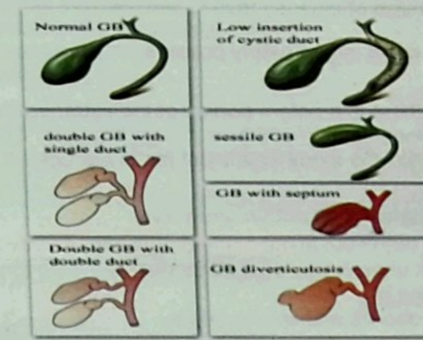
{Invertogram}
X-Ray بنصور
24h → بعد الولادة
عشان يكون اكل
والا كل طلع غازات
هنشوفها في ال X-Ray Blind Pouch
inverted والمصور والولد
راسه تحت و رجله فوق
ومعلم ال Anus ب Coin
و اقيس المسافة
بين الغازات

J. Biliary System Congenital Anomalies

- Congenital anomalies of the biliary tract are present in 10% of autopsies.

I. Congenital Anomalies of the Gall Bladder

1. **Anomalies of number:**
   - Congenital absence (0.03% of cases).
   - Double gall bladder with single duct or double ducts (1 in 4000).
2. **Anomalies of shape:**
   - Septate GB.
     - The most common form is: Phrygian cap (2-6 %): kinking of the fundus of the GB. (Of no clinical significance).
3. **Left sided gall bladder.** (Extremely rare)
4. **Floating gall bladder** → Hangs on a mesentery & liable for torsion
5. **Intrahepatic gall bladder** → Associated with increased incidence of stones.



II. Congenital Anomalies of the Bile Ducts

1. Biliary atresia (see later).
2. Choledochal cyst (see later).
3. Hepatic duct anomalies:
   - Accessory hepatic duct may enter into cystic duct or into the neck of the GB
   - Rt., Lt. or both hepatic ducts may enter the G.B. Their ligation during cholecystectomy could result in surgical catastrophe.
4. Cystic duct anomalies:
   - Absence of cystic duct → Injury of CBD may occur during cholecystectomy.
   - Low insertion of the cystic duct → It is a common anomaly; where the cystic duct opens into CBD near ampulla leading to its ligation during cholecystectomy.
   - Sessile GB (no cystic duct) → injury of CBD during cholecystectomy.
   - Cystic duct may enter Rt.hepatic duct → mistaken for cystic duct and ligated.

WhiteKnightLove

III. Congenital Anomalies of the Blood Supply

A- Accessory cystic artery (the most common anomaly).
→ May be torn if not identified.
B- Large accessory Lt. hepatic artery
→ May arise from left gastric artery in 5 %.
C- Right hepatic artery
→ May arise from superior mesenteric artery
D- Right hepatic artery
→ May pass in front or behind the CHD or CBD.
→ May be mistaken for cystic artery & ligated.



IV. Biliary Atresia
(Neonatal obstructive jaundice)

Incidence
- 1 / 10,000 live births.

Etiology
- Unknown, may be the result of inflammatory process

Types
1- Correctable type (10%) : there is a patent portion of the extrahepatic duct which communicate with intrahepatic ducts
2- Non correctable type (90%) : the extrahepatic portion is occluded & appears as a cord structure.

Clinical Picture (Neonatal obstructive jaundice)
- Jaundice is present since birth but is not marked until after 1st several weeks.
- Olive green jaundice, dark urine & clay colored stools).
- Abdomen may be distended by:
  - Hepatomegaly, ascites and splenomegaly.

Complications
- If untreated → biliary cirrhosis & death.



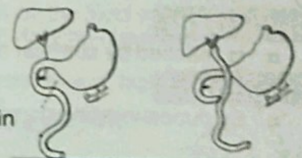
DD Causes of neonatal jaundice
A. Physiological jaundice.
B. Hemolytic diseases.
C. Obstructive jaundice: e.g. inspissated bile syndrome, choledochal cyst, α-1 antitrypsin deficiency
D. Hepatocellular jaundice:
- Neonatal hepatitis.*(the most important item in DD)*
- Viral infections.
- Metabolic defects.

Investigations
1. **Laboratory:**
- **LFTs: cholestatic pattern**
  - ↑ serum bilirubin (direct fraction is at least □ of the total).
  - ↑ alkaline phosphatase.

2. **Radiological:**
- **HIDA scan**: non-visualization of the duodenum (no passage of bile and isotope to the duodenum).It virtually confirms atresia.

3. **Laparotomy:**
- Needed to confirm the diagnosis.

Treatment
Should be done before 2 months or around it
- **Correctable type** → (Removal of extrahepatic stenosis & its replacement by small intestine.
  → Roux-en-Y operation is done.
  → A loop of the jejunum is anastomosed to a patent portion of the extrahepatic biliary tract. (hepatico-jejunostomy).
- **Non correctable type**
  → **Kasai operation** is done; (porto-enterostomy) in which excision of bile ducts up to liver capsule is performed and Roux-en-Y loop of jejunum is anastomosed to expose area of liver capsule to drain bile from minute biliary channels.
  → Liver transplantation: This is done if Kasai operation (porto-enterostomy) failed.



Roux-en-Y operation

V. Choledochal Cyst
(Obstructive jaundice in childhood)

Definition
- Congenital dilatation of common bile duct.

Incidence
- intra and / or extrahepatic biliary system
- There is a female predominance .

Etiology
(Unknown)

Pathology
- It leads to dilatation of intra and / or extrahepatic biliary system.
- Diffuse fusiform dilatation is the most common type.

Clinical Picture (Childhood obstructive jaundice)
- Jaundice, pain & right hypochondrial mass☑. are the main clinical presentations.
- Recurrent attacks of pyrexia may occur due to cholangitis.

The majority of cases are diagnosed in childhood before 10 years of age

Complications
- **Cholangiocarcinoma**.
- Biliary cirrhosis.

Investigations
- See biliary atresia

Treatment
➢ Excision of the cyst + choledochojejunostomy.

'It is more blessed to give than to receive.

K. Pancreas Congenital Anomalies

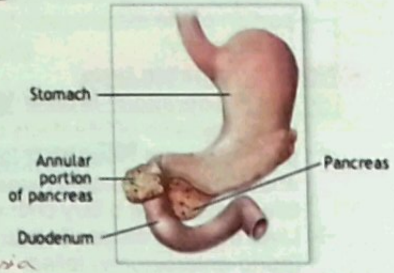
Annular pancreas

Pathology
- A ring of pancreatic tissue that surrounds the second part of the duodenum.

Clinical presentations
- May present by duodenal obstruction, with half of the cases presenting during the first year of life.
- Vomiting is the main symptom and jaundice may be present.

Diagnosis
- Is reached by contrast radiological studies.

Treatment
- By duodenojejunostomy.



UROSURGERY IN PEDIATRICS

I. Renal anomalies

A. Solitary (simple) cyst of the kidney

Etiology
- Not clear whether the lesion is congenital or acquired. Its origin may be similar to polycystic kidney or may be related to tubular obstruction.

Pathology
- **The cyst:**
  - Contains clear fluid & may contain altered blood.
  - Lined by flat epithelium.
  - Surrounded by fibrous tissue & **compressed** renal tissue.



Clinical picture
- **Usually asymptomatic.**
- Dull aching **pain** in the loin due to stretch of renal capsule.
- A **swelling** may be felt in the loin.
- Clinical picture of complications (e.g. hematuria, pyuria…etc.)

Complications
- Hemorrhage.
- Rupture, pressure on ureter (→ hydronephrosis).
- Infection & calcification.

Investigations

> **The criteria of benign cyst:**
> Smooth wall, clear fluid, **no septa**, no malignant cell in aspirate, no residual mass after aspiration

A- **For Diagnosis:**
1. **U/S is very helpful:**
2. **IVU:**
   - Smooth amputation of a calyx.
   - Localized smooth spider leg appearance.
3. **Renal angiography:** (not done now) → differentiate between cyst & tumor:
   - Cyst → avascular.
   - Tumor → abnormal vascularity.

B- **For complications:**
- Urine analysis: pus cells if infected.

Treatment
1. No treatment but follow up is required.
2. If the cyst cause hydronephrosis, treatment aspiration of the fluid in the cyst and sclerosing by 95% alcohol. Marsupialization or excision may be required.
3. Atypical cyst (hemorrhagic, thick wall or cloudy fluid):
   - Percutaneous needle aspiration of content for analysis. Blood, high fat content or positive cytology gives high suspicion of malignancy.
   - Excise the extrarenal portion of the cyst (Kirwin's operation).
   - Partial nephrectomy may be considered.

B. Multi-cystic disease of the kidney
- Unilateral multi-cystic disease is much more common than polycystic kidney.
- Non hereditary disease.
- Associated with contralateral renal or ureteric abnormalities.
- It presents as non-functioning mass in the flank.
- Nephrectomy is the treatment of choice as neoplastic changes have been noted.

C. Congenital polycystic kidney

Definition
- Congenital enlargement of both kidneys by multiple cysts.

Etiology
- Unknown cause → failure of fusion of mesonephric ducts with the metanephric ducts.
- The condition is usually familial with autosomal dominant inheritance (adult type), but slightly more common in females.
- It might be a part of cystic changes of the body (18% of patients have liver cysts, 30-40 % have intracranial aneurysms).

> **Types:**
> 1- Adult type: AD inheritance. More common (see below)
> 2- Infantile type: AR inheritance, usually stillbirth or dies shortly after birth from uremia.

Pathology
Site
- Always bilateral but one side is more affected than the other.

Macroscopic

⇨ **Wall:**
- Multiple cysts; not intercommunicated & are **not connected to the renal pelvis**.
- Surrounded by compressed atrophied renal tissue.



➪ Content:
- Amber clear fluid is the usual content.
- May be hemorrhagic or infected.

Microscopic
- The cysts are lined by flattened epithelium.

Clinical picture

The condition is not usually detectable on standard imaging until 2nd or 3rd decades of life and does not usually manifest itself before the age of 30 years.

- By 10 years old → no symptoms (normal function and anatomy).
- From 10-30 years old → patient is asymptomatic but cysts could be demonstrated by U/S.
- After 30 years old:
  - Pain → dull-aching in flanks (stretch of capsule), severe if complicated.
  - Swelling → irregular upper quadrant abdominal mass (in the loin).
  - Complications:
    - Hematuria either microscopic or gross (due to rupture of cyst in the pelvis).
    - Infection (due to stasis of urine).
    - Hypertension (75%).
- Between 40-50years old → renal function impairment.
- By > 50 years old → renal failure.

Complications

General
- Hypertension (75%).
- Renal failure.

Local
- As any cyst (Infection - pressure atrophy - calcification - hemorrhage - rupture)

DD
- Mass in renal angle (hydronephrosis, hypernephroma, liver swellings on the right side, splenomegaly on the left side).

Investigations

1-For diagnosis
- U/S or CT scan → **most accurate** → multiple cysts in both kidneys.
- IVP → bilateral smooth spider leg appearance with elongated renal shadow.
- Cytological examination of cyst fluid obtained by fine needle aspiration.

2-For complications
- KFT (for renal failure).
- Urine analysis→ hematuria or pyuria.
- Plain x-ray→ calcification.

3-For screening (for other family members)
- U/S for family members above 20 years old.

Treatment

A-Treatment of congenital polycystic kidney:

1. Medical: to control the complications until renal transplantation is available.
   - Prevention of uremia → decrease proteins in diet.
   - Hypertension → ACE inhibitors.
   - Secondary infection → antibiotics.
   - Anemia → erythropoietin.
2. Surgical: **Rovsing's operation (marsupialization) → rarely indicated:**
   - Puncture of cysts to diminish pain & pressure on the renal parenchyma.

Nephrectomy is contraindicated except if renal transplantation is possible

B-Treatment of complications:

- **Replacement therapy (for renal failure):** Dialysis, kidney transplantation.

C-Genetic counseling:

- For newly married couples planning to have children.

Infantile polycystic kidney

- Very large kidneys may obstruct labour.
- Newborn with severe form of the disease may die from respiratory failure due to pulmonary hypoplasia or uremia.

D.Other renal anomalies

1. Congenital fusion:

➧ **Horse-shoe kidney:**

✎ Pathology:
- Fusion occurs early in embryonic life when the kidneys lie low in the pelvis.
- Ascent of the kidney is arrested by the isthmus being blocked by the IMA.
- The renal pelvis lies on the anterior surface of the kidney.
- The ureters thus ride over the isthmus which connects the lower poles.



✎ C/P:
1. 1/3 of the patients remain asymptomatic.
2. The rest develop symptoms of complications as pain, hematuria and fever.
3. A hydronephrotic horseshoe kidney may be palpable below the umbilicus.

✎ Investigations: IVU → the kidneys are in lower position, the lower poles are nearer to the midline and the lower pole calyces point medially and lie medial to the ureter (**Flower vase appearance**).

✎ TTT: only if complicated & non functioning → division of isthmus at the level of inferior mesenteric artery (L3).

2. Ectopic kidney:

- **Site:** usually near the pelvic brim and usually left sided.
- **Etiology:** failure of renal ascend & rotation.
- **Clinical picture:**
  - Gives mass in iliac fossa.
  - Renal ectopia may present diagnostic problems when acute disease develops in the kidney.
  - Surgeon may remove it by mistake as an unexplained pelvic mass.
- **Investigations:** IVU → ureter is short & straight.
- **DD:** abnormal mobile kidney (ptosed - floating).



Ectopic kidney

'It is more blessed to give than to receive.

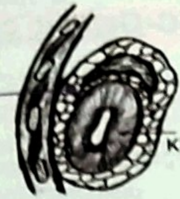
3. Aplasia.

4. Hypoplasia.

5. Dysplasia.

6. Abnormal mobile kidney:

- Normally both kidneys move up & down with respiration for 1 inch in the **Züker Candle fascia**
- Abnormal mobility may be:



[A] Floating kidney:

With mesentery

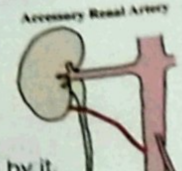
1. **Can be pushed** in all directions & **to the renal angle**.
2. **Complications**: torsion & gangrene (acute abdomen).

[B] Ptosed kidney:

- **Etiology:**
  1. Wasting & regimens (↓ peri-renal fat).
  2. Labor, pregnancy & repeated trauma.
  3. Tight abdominal corset.
- **Clinical picture:**
  - **Symptoms:**
    - Mainly asymptomatic.
    - GIT complaints → traction of **d**uodenum → distention & vomiting.
    - Urinary complaints:
      1- Loin pain & hematuria (**D**eitl's crisis).
      2- **D**ragging loin pain and firm mobile abdominal swelling.
  - **Signs:** *(during full inspiration)*
    - **1st degree:** the lower ☐ of the kidney is felt.
    - **2nd degree:** the whole kidney is felt.
    - **3rd degree:** floating kidney.
- **Complications:** - Stone. - Infection. - Hydronephrosis.
- **Investigations:**
  - **IVU:**
    - During full inspiration & expiration → mobility > 1 vertebra).
    - Abnormal position + kinked ureter.
- **Treatment:**
  - Mainly conservative (weight gain, exercises & avoidance of corset).
  - Surgical → nephropexy.

E. Anomalies of renal vessels

1. Accessory renal artery:



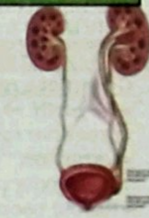
- From renal artery → compress PUJ.
- Diagnosed by angiogram, IVU (transverse filling defect).

2. Aberrant renal vessels:

- From aorta or common iliac, commonly on the left side.
- End-arteries, if divided → infarction of the area of medulla supplied by it.
- Renal veins, by contrast, have extensive collaterals and an aberrant vein can be divided.

II. Pelvi-ureteric anomalies

Double ureter (Bifid pelvis):



- This is the most common anomaly of the upper urinary tract and is found in 4% of individuals.
- It is more common on the left side/ this lesion is harmless.

III. Anomalies of urinary bladder

A. Ectopia vesicae (Bladder Exstrophy)

Definition

A congenital anomaly characterized by absence of:

- The lower part of the anterior abdominal wall + anterior bladder wall.
- Usually associated with epispadius **(exstrophy-epispadias complex)**.

Incidence

- 1:50000 live births.
- Male : female ratio = 4:1

Etiology

Theories:

1. Failure of union between the 2 sides of the bladder & 2 sides of the abdominal wall.
2. Intrauterine rupture of UB through ant. abd. wall due to delayed rupture of cloaca.

Clinical picture

1. **Absence of:**
   - Absent lower anterior abdominal wall. - Umbilicus.
   - Absent anterior bladder wall.
2. **Widening of symphysis pubis** → waddling gait.
3. **Genitalia:**
   In male: epispadius (exstrophy-epispadias complex) + rudimentary prostate, seminal vesicles and penis (broad & short) + bifid scrotum + bilateral undescended testes ± bilateral inguinal hernia.
   In female: bifid clitoris + anterior separation of labia minora → exposed vaginal orifice.
4. **Associated anomalies:** e.g. spina bifida, cleft lip.



Rudimentary penis,undescended testes with bifid scrotum



Complications

1. Cystitis & ascending pyelonephritis → death before 30 years.
2. Skin excoriation & ammonia cal odor.
3. Ulceration & bleeding from exposed bladder mucosa.
4. Chronic irritation of bladder mucosa → bladder carcinoma.

Investigations

- Antenatal diagnosis is possible by ultrasound.
- **Plain X- ray**: wide separation of the symphysis pubis.
- **IVU**: for associated urinary tract anomalies.



Treatment

A. **Complete reconstruction:**

- **At birth** → temporary closure of defect + drainage to preserve renal function.
- **Later on** → bladder augmentation to increase size and preserve continence (appendix can be used for augmentation)
- **Pelvic reconstruction** → by corrective osteotomy.
- **If continence cannot be preserved** → permanent diversion (ureterosigmoidostomy or ileal conduit).

B. Urinary bladder diverticulae

Definition

- A bladder diverticulum is a flask-shaped protrusion through the muscle wall of the urinary bladder.

Etiology



1. Congenital diverticulum:

- Rare (represent unobliterated vesical end of urachus).
- Solitary → located medial to and above the ureteric orifice (midline antero-superiorly).
- Rarely multiple.
- It has muscle fibers within its wall → contractile.

2. Acquired diverticulae (Pulsion diverticulae):

- Often multiple.
- Always associated with distal obstruction → trabeculation & sacculation of the bladder.
- There are no muscle fibers in the fundus and they do not empty during micturation.

> Traction diverticulum = hernia of bladder through inguinal or femoral hernia = sliding hernia

Clinical Features

- The patient is almost always male 95% over 50 years.
- No specific symptoms (usually accidentally discovered on U/S or cystoscopy).
- In congenital type: may be filled with urine during micturation → empty into UB → produce an immediate desire to pass urine **(double micturation)**, the second may follow a change of posture).
- Complicated diverticulae will rise to frequency, pain and hematuria.

Complications

⇨ **Stagnation of urine in the diverticulum may result in:**

- Infection (recurrent).
- Stone formation.
- Hydroureter and hydronephrosis (extremely rare and is a consequence of peri-diverticular inflammation and fibrosis).
- Squamous metaplasia.
- Rarely, a squamous cell carcinoma (< 5%).

Diagnosis

1. **Cystography:** descending (= IVU) or ascending → demonstrates the diverticulae.
2. **Cystoscopy:** → demonstrates diverticular openings within UB.

Treatment

- Diverticulectomy (only if complicated or producing ureteric obstruction).
- Treatment of the cause.

C. Bladder neck obstruction (BNO, Marion's disease)

Incidence

- Usually occurs in men, but can rarely affect children of both sexes.

Etiology & Pathology

1. **Due to muscle hypertrophy:**
   - Muscular hypertrophy of the internal sphincter in a young person with the development of a vesical diverticulum or hydronephrosis **(Marion's disease)**.
2. **Due to fibrosis of tissues at the bladder neck:**
   - Symptoms similar to those of prostatic enlargement, due to scarring after TURP.

Investigation

- Urodynamic study → demonstrates raised voiding pressures and diminished flow rate.

Treatment

1- **Medical**

Alpha-blocking drugs:
- Doxazosin, Prazosin Terazosin (highly effective).
- These drugs are not target specific and the patients must be warned of the possibility of postural hypotension.

2- **Surgical**

Transurethral incision:
- Transurethral incision of the bladder neck is the operation of choice.
- Recurrence may occur, due to inadequate division of bladder neck fibers.

IV. Anomalies of the urethra

A. Epispadias

Definition

- A congenital anomaly of the urethra in which the urethra opens on the dorsal surface of penis associated with upward curvature of the penis.

Incidence

- Male → 1:120,000.
- Female → 1:500,000.



Pathology

1. **Incomplete type:**
   - Subdivided into → glanular, mid-penile or peno-pubic.
   - The patient is continent.
2. **Complete type:**
   - The condition is associated with ectopia vesica (exstrophy-epispadias complex).
   - The patient is incontinent.

Treatment

1. **Incomplete type:** as hypospadias (within 7 years) but on the dorsum of the penis.
2. **Complete type:** as ectopia vesica.

B. Hypospadias

Definition

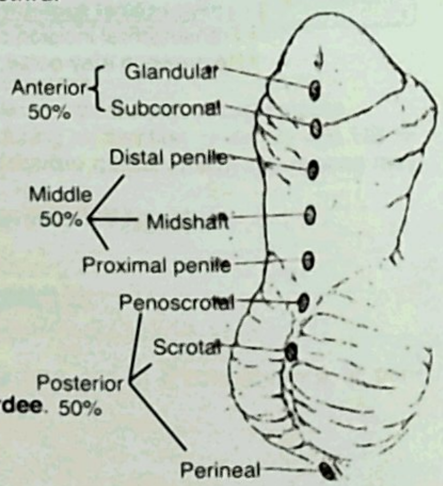
- A congenital anomaly of the urethra in which the urethra opens on the under surface of penis or perineum and the ventral surface of prepuce is poorly developed.

Incidence

- 1:150 – 300 boys.
- **The commonest congenital anomaly of urethra.**
- Positive family history in 8% of cases.

Types

1. **Glanular type (commonest)** → EUM opens on under surface of the glans.
2. **Coronal Meatus** is at the coronal sulcus.
3. **Penile type:**
   - EUM opens on the under surface of the shaft of the penis. It may be:
     - A- Anterior penile.
     - B- Mid-penile.
     - C- Posterior penile (peno-scrotal).
   - The distal part of urethra (corpus spongiosum distal to the urethral opening) is replaced by fibrous band.
   - This fibrous band is known as **urethral chordee**.
   - It causes curving of the penis downward on erection.



4. **Penoscrotal.**
5. **Perineal type:**
   - The scrotum is split.
   - The urethra opens between its 2 halves.
   - The penis is rudimentary.
   - The testes may be undescended.



► Hypospadius is anterior in 65% of cases, midpenile in15%, and penoscrotal or perineal in 20% of cases.

Etiology

1. **Glanular type**: occurs due to failure of re-canalization at the glans of penis.
2. **Penile type**: occurs due to failure of fusion of inner urethral folds.
3. **Perineal type**: occurs due to failure of development of whole penile urethra.

Clinical picture

Depends on age of patient and severity of disease:

- **At birth:**
  - Abnormal prepuce present dorsally only **(hooded prepuce).**
  - Urethral opening more proximal than usual.
- **2-10 years:** wetting the clothes in micturation (abnormal stream).
- **10% of patients** have inguinal hernia or undescended testis.
- **8% of patients** have upper urinary tract anomalies.
- **After puberty:**
  - Bowing of penis downwards during erection due to presence of fibrous chordee.

Glanular type is a psychological concern, while other types will impair the function

Complications

- Psychological distress.
- Pseudo infertility.
- Dyspareunia.
- Associated hormonal manifestations (rare).

Investigations

a. **For associated conditions:**
   - Hormonal assay and karyotyping (if bilateral undescended testes with hypospadias).

b. **To assess success of surgery:**
   - Ascending urethrogram postoperatively.

Treatment

Circumcision should be avoided in all cases of hypospadias as the skin of the prepuce may be used in the repair later on

⇨ **Timing:** at 6-18 months → improved emotional and psychic results.

⇨ **Aim:**
- Straight urine stream → psychological and social concern.
- Correction of bowing of the penis → correct sexual function.

⇨ **Principle:**
1- Removal of the chordee to correct the ventral curvature.
2- Urethral reconstruction using skin from the prepuce or penile skin.
3- Circumcision after that.

C. Other anomalies of the urethra





⇨ Phimosis

- Congenital contraction of the prepuce which **will not retract** over the glans resulting in "pin hole" meatus & lower urinary tract obstruction.
- It may be acquired as in balanitis xerotica obliterans.
- Treatment: circumcision.

⇨ Paraphimosis

- The prepuce becomes tightly retracted beyond the base of the glans or on the shaft of the penis.

⇨ Urethral stricture

⇨ Anterior urethral valve

⇨ Posterior urethral valve

➤ Obstruction is caused by congenital valve in the posterior urethra causing a severe form of obstructive uropathy.

➤ **Clinical picture**

Symptoms:

- Antenatal diagnosis→bilateral hydronephrosis.
- In neonatal period→poor stream, acidosis, and raised blood urea.
- Urinary tract infection in the dilated system resulting in septicemia.
- Older children→poor urinary stream, hematuria, or retention of urine.

Signs:

- It shows a distended bladder and palpable kidneys.

➤ **Investigations**

- **Ultrasound** → dilatation of pelvi-calyceal system, thinning of the cortex, distended bladder and dilated ureter.
- **Micturating cysto-urethrogram** → shows distended posterior urethra, vesico-ureteric reflux, bladder trabeculation and diverticulae.
- **Renal function tests:** for complications.

➤ **Management**

Depends on the renal function and general condition of the patient (neonate):

1- **Emergency measures to relieve obstruction and improve renal function:**
   a- Insertion of urethral catheter to drain the bladder and bypass the obstruction.
   b- Resuscitation → correction of the dehydration, acidosis, and antibiotic prophylaxis.

2- **Definitive treatment:** when the renal function improves:
   a. If there is available urethroscope to deal with neonatal urethra → **endoscopic Electro-fulguration** of the valve is the ideal treatment.
   b. If not available → urinary diversion (usually vesicostomy or ureterostomy occasionally) is done until it is possible to fulgurate the valve endoscopically.

V. Anomalies of the Testis

A. Incompletey descended testis

Definition

- The testis is arrested at any site on the **normal** pathway to the scrotum.
- Better to be called **arrested testicle**.

Etiology

⇨ **Unilateral cases:** *(mechanical causes)*

- Dysgenesis (small testis).
- Short testicular artery.
- Short spermatic cord.
- Large testis.
- Band of adhesions.
- Associated hernial sac.
- Inadequate inguinal canal or rings.

⇨ **Bilateral causes** *(hormonal causes or bilateral mechanical)*

It may lead to ***Cryptorchidism*** *→ hypogonadism.*

- Deficiency of ***maternal*** HCG
- Deficiency of ***fetal*** pituitary gonadotropin (testis not sensitive to gonadotropins).

Incidence

- 1% of all males and higher incidence in premature infants
- Side:
  - 50% right side (due to later descend of the right testis, So testicular tumors are more common on right side)
  - 30% left side.
  - 20% bilateral.
- Urinary tract anomalies in 13.5%.

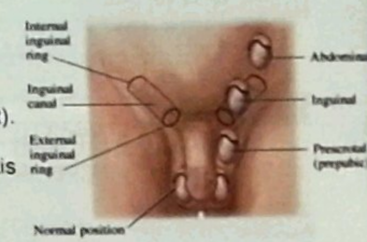
Risk Factors

- The mother has a family history of unexplained newborn deaths or abnormal genitalia.
- The fetus has Down syndrome.
- The mother is younger than 20 or older than 35.
- The mother has been exposed to pesticides or other toxic chemicals.
- The mother is in poor health.

Sites

⇨ **The sites of arrest:**

1. Intra-abdominal.
2. Inguinal canal.(most common site of arrest).
3. Superficial inguinal pouch (very rare): it must be differentiated from retractile testis which is more common.
4. At neck of scrotum



Complications

1. **Psychological**.
2. Liability to **trauma & torsion** which may occur intra-uterine leading to vanishing testis (DD: strangulated hernia).

3. **Epididymo-orchitis** due to urinary tract anomalies e.g. stricture → UTI infection
4. **Sterility:** *In bilateral cases (cryptorchidism)*
   - Due to injury of the ***exocrine*** function of the testis due to destruction & hyalinization of the semineferous tubules.
   - There is no effect on ***endocrine*** function (normal testosterone, normal 2ry sexual characters, erection, ejaculation "prostatic fluid" & no impotence but Azoospermia)
   - This becomes irreversible destruction by the age of 16 years.
5. Liability to malignancy (**Seminoma**) *30 times* more than normal.
   - This is due to dysgenetic testis (& may affect the patient even after a successful orchiopexy) so orchiopexy is done only for early detection of malignancy.
6. **Indirect inguinal hernia** is present in about 90% of cases & might be complicated.

Clinical Picture

Symptoms

- **Mother** complains that one or both sides of her baby scrotum are empty.

Signs

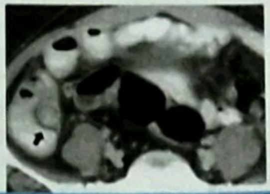
1. **The Scrotum:**
   - Empty scrotum (unilateral or bilateral)
   - **Poorly** developed scrotum.
   - The median scrotal raphe is deviated towards the affected side.
2. **The Testis:**
   - Usually present **in** the inguinal canal.
   - It is **not well developed**.
3. **Associated other anomalies (hypospadius)**

Why is the undescended testis difficult to feel?
- Dysgenesis (small testis).
- Behind it fascia transversalis.
- In front of it the aponeurosis of external oblique muscle.



DD

1. Ectopic testis
2. Retractile testis.
3. Surgically removed testis.
4. Agenesis.
5. Hermaphroditism : should be excluded in bilateral cases



C.T. of intra-abdominal testis

Investigations

The most important investigation is laparoscopy

Radiological

1. **U/S & CT scan**
2. **IVP** for associated urinary anomalies

Instrumental

- **Laparoscopy** (the best).



Laparoscopic view of intra-abdominal testis

Laboratory

1. Karyotyping in the bilateral cases.
2. Hormonal assay (testosterone and LH) to exclude cases of anorchia in bilateral cases

Treatment **(Surgery is the standard treatment)**

I. Treatment of incompletely descended testis:

Bilateral cases

⇨ **Hormonal therapy (success rate 10%)**
- We might give **B-HCG 500 U I.M twice per week for 4 wks**

> Never to give beta HCG for more than 6 weeks as testosterone secretion will occur.
> - Never to give testosterone as it leads to short stature due to closure of epiphysis.

- In bilateral adult cases → no role for hormonal therapy because adult has full hormones.

⇨ **Orchiopexy:**
- If hormonal therapy failed or adult case. Wait 6 months between the two sides.

Unilateral cases

- We do orchiopexy for the affected side.

⇨ **Orchiopexy**

A. Under ideal circumstances orchiopexy should be performed between 6-24 months
B. Divide adhesions to elongate the cord
C. Methods of fixation
   - Place the testicles in Dartos pouch created bewteen skin and Dartos muscle (De Neto)
D. If there is short Cord →Dissect the cord to elongate it.
   If the cord is not long enough one of the following might be done:
   1. The testicular vessels can be divided & testis is mobilized on a pedicle containing the vas & the artery of the vas (Fowler-Stephen technique).
   2. Autotransplantation using microvascular anastomosis between the distal end of testicular artery & the inferior epigastric vessels to add more blood supply to the testis.
   3. *Two stage operation with interval 6 months.*

> - In bilateral cases repair one side and the other side after 6 months
> - Orchiectomy is done only if the other testes is normal and the undescended one is atrophic

II. Repair of associated hernia (if present)

> **Patient with one testis removed and the other is short with no hope for descent???**
> **→ Orchiocelioplasty**
> Abdominal replacement for preservation of hormonal functions & avoiding torsion

B. Hydrocele

Definition

- It is collection of serous fluid inside a part or the processus vaginalis.

Types

A. **hydrocele of tunica vaginalis:**
   1- Congenital.
   2- Infantile.
   3- Vaginal hydrocele (1ry or 2ry)

B. **Hydrocele of spermatic cord:**
   1- Encysted hydrocele of the cord
   2- Diffuse hydrocele of the cord.
   3- Hydrocele of hernial sac.

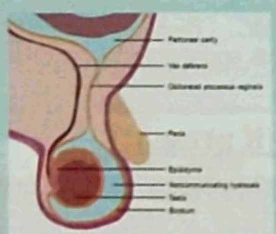
C. **Rare types:**
   1- Hydrocele of canal of Nuck (in females lies).
   2- Tyre hydrocele: recurrent after eversion.
   3- Hydrocele en bisac: one below scrotal neck and one above.

Etiology

1- Excessive fluid formation as in secondary hydrocele.
2- Spermatic cord lymphatic obstruction by filariasis or low grade infection.

Complications

1- **Hernia of the hydrocele sac**: in long standing cases the sac might herniate through the Dartos muscles that may rupture.
2- **Hematocele**.
3- **Infection**.
4- **Rupture** usually traumatic but might be spontaneous
5- **Calcification**.
6- Bilateral huge cases might lead to **atrophy of the testis**. In unilateral cases →no atrophy as hydrocele distends in wide scrotum

Infantile Hydrocele	Congenital Hydrocele
Causes	
The sac has no connection with the peritoneum 	• It is due to failure of the obliteration of the processus vaginalis. • It connects with the peritoneal cavity. • **Small opening** allow passage of fluid but not intestine. • It is either uni or bilateral 
Clinical Picture	
Symptoms • Swelling….. • There is no fluctuation in size	**Symptoms** • Mother reports that the baby has a swelling in the scrotum. • There is fluctuation in size by day and night.

Infantile Hydrocele	Congenital Hydrocele
Sings	
• Cystic, translucent inguinoscrotal swelling. • Not reducible manually.	
Treatment	
❖ Eversion of the tunica. **N.B:** *Infantile Hydrocele is not necessary to occur in infants*	Conservative for 6 months waiting for spontaneous closure, if not excision of the upper part of the sac till the internal ring.

i. Primary Vaginal Hydrocele

Causes

Its cause is unknown . chronic congestion & irritation by repeated trauma and/or decrease fluid absorption by tunica are possible causes

Incidence

- Vaginal hydrocele occurs in middle aged male but not uncommon in early childhood

The Fluid

- Thin Amber yellow water, contains albumin , fibrinogen in concentration that resembles transudate , cholesterol in old standing cases

Clinical Picture

Symptoms

- Painless swelling in one of the scrotal compartment (gradual onset, progressive course, long duration)



Signs

- Inspection→Swelling in one scrotal compartment
- Palpation →non tender, cystic, translucent (by transillumination test) and purely scrotal swelling.
- No impulse on cough

Investigations

- No investigations are needed as its clinical diagnosis, however if there's rapidly accumulating hydrocele, the patient should be investigated for malignancy.
- If hydrocele sac is tense → U/S scan to visualize the testis is necessary.

Complications

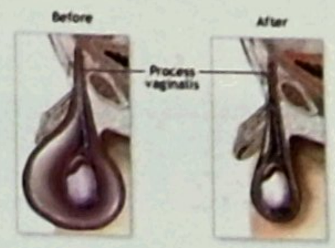
See before

Treatment

1. **Lord's operation (plication of tunica vaginalis)**
   Aims to make the fluids in contact with lymphatics of the scrotum.



   Steps
   1. Antero-lateral incision is made in the scrotum.
   2. The tunica is opened.
   3. The fluids are evacuated.
   4. The tunica is plicated.
   5. Tunica is not removed to avoid hemorrhage.
   6. Drain is inserted



2. **Subtotal excision of the tunica vaginalis:**
   It is done in cases of:
   1- Calcified tunica.
   2- Loculated hydrocele.
   3- Recurrent hydrocele after eversion of tunica.

3. **Eversion:**
Suitable for small hydrocele but may be complicated by recurrence.

Aspiration is not used except in high risk bad general condition patient as aspiration might leads to hematocele , pyocele, recurrence or injury of the testis

ii. Other rare types of Hydrocele

Secondary Vaginal Hydrocele

Causes
- Disease in testis, cord, epididymis or postoperative after repair of hernia.
- It is usually lax & rarely attains large size except in malignancy.
- If there is possibility to be with testicular tumor U/S, pregnancy test, alpha feto protein or even exploration and frozen section is done.

Encysted Hydrocele of the Cord



Causes
- Failure of obliteration of the middle portion of the processus vaginalis.
- It becomes distended with fluids

Clinical Picture

Symptoms
- Child or adult with painless swelling in the scrotal compartment.

Signs
- Cystic, painless, translucent swelling.
- It is scrotal swelling.
- Separated from the testis by interval.
- **It is mobile across the cord.**
- **Its mobility is restricted on downward traction of the testis. (traction test)**

Treatment
- Excision

Diffuse Hydrocele of the Cord
- Due to chronic lymphatic obstruction , usually due to filariasis
- 80% of cases in tropical countries.
- In many cases there is no history of filariasis.

Pathology
- Acquired obstruction of cord lymphatics by filaria → lymphangiectasis → lymphocele or chylocele

Clinical Picture
- Lymphocele is cystic, translucent, irreducible, soft, dull, diffuse inguinoscrotal swelling with no expansile impulse on cough
- Funiculitis is common as the cord is thick & matted.
- The presence of chyle proves the filarial origin.
- Hydrocele is commonly bilateral

Hydrocele of Hernial Sac
- Occurs in narrow necked sac if contents return to abdomen and neck becomes occluded by omentum allowing serous fluid to collect in the sac

Hydrocele of Canal of Nuck
- Equal processus vaginalis in male
- ***In female…cyst in relation to round ligament***
- it is always or partially in the inguinal canal
- it equals encysted hydrocele of the cord in female.

Hydrocele en Bisac
- 2 communicating sacs: - One below scrotal neck. - One above scrotal neck.

PLASTIC SURGERY IN PEDIATRICS

A. Cleft lip & palate

➡ See Plastic surgery

B. Swellings

➡ See Plastic surgery

CHILDHOOD TUMORS

- Incidence of malignant tumors is less in children.
- Response treatment is better in children especially combined therapy.
- Prognosis is better in childhood tumors even in metastasizing tumors.
- **Incidence of childhood tumors:**
  1. Acute lymphocytic leukemia.
  2. Brain tumors.(1st solid tumor)
  3. Neuroblastoma.(adrenal gland tumor)
  4. Nephroblastoma. (Wilm's tumor)
  5. Hepatoblastoma.
  6. Rhabdomyosarcoma. (skeletal muscle tumor)
  7. Saccrococcygeal teratoma.

Clinical picture

General • Fever, anorexia & failure to thrive

Local
- Pain: during metastases (excellent prognosis)
- Swelling: abdominal swelling : nephroblastoma, neuroblastoma.
- Disturbance of function: paresis , incontinence

Neonatal period	1- Neuroblastoma. 2-Sacrococcygeal teratoma. 3-ovarian cystic lesions.
0-2 years	1- Nephroblastoma. 2-Neuroblastoma. 3- Hepatoblastoma.
2-6 years	1- Rhabdomyosarcoma. 2- Ovarian tumor. 3-Malignant lymphoma.